PORTLAND HARBOR RESIDUAL RISK ASSESSMENT APPROACH

1 INTRODUCTION

The objective of this document is to provide the U.S. Environmental Protection Agency (EPA) with a proposed approach for completing a residual risk assessment to support the revised Feasibility Study (FS) for the Portland Harbor Superfund Site (Site). Residual risk refers to the potential risk to humans and ecological receptors remaining after implementation of active remedial alternatives and long-term risk reduction (i.e., 45 years). The magnitude of residual risk is considered during alternatives evaluation under the following criteria: 1) overall protectiveness of human health and the environment; and 2) long-term effectiveness (EPA 1988), which are two of the seven Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) evaluation criteria that serve as the basis for conducting the detailed analysis of the remedial alternatives in the FS. Residual risk estimates assist in the comparison of remedial alternatives and in the determination of the efficacy of the preferred remedy in addressing baseline risks to human health and the environment. The residual risk assessment can also be used to provide context for proposed remedial alternatives in comparison to the lowest achievable risk level that can be theoretically attained based on background conditions. In addition to using residual risk to compare the remedial alternatives, the results can be used to refine the alternatives.

EPA provided the Lower Willamette Group (LWG) the opportunity to prepare a residual risk assessment in response to LWG concerns that the EPA-proposed methods of using sediment Preliminary Remediation Goals (PRGs) to evaluate the revised FS alternatives would not accurately capture the protectiveness and effectiveness of various alternatives due to differences between the EPA-proposed application of the PRGs and the risk assessment methods used in the Final Baseline Human Health Risk Assessment (BHHRA; LWG 2013a) and the Final Baseline Ecological Risk Assessment (BERA; LWG 2013b). The residual risk assessment methods detailed in this document were developed to maintain consistency between the FS alternatives evaluation and to provide a direct comparison to the baseline risks defined in the BHHRA and BERA. These residual risk assessment methods will ensure that the magnitude of residual risks and risk reductions for remedial alternatives are evaluated consistently between the baseline risk assessments approved by EPA and the risk-based considerations in the FS. Ultimately, the incorporation of the residual risk evaluation results will result in an alternative selection process in the FS that is risk-based—consistent with EPA guidance (EPA 1991a, 1991b).

The draft FS was submitted in March 2012 (LWG 2012) and was prepared using results from the draft final baseline risk assessments in order to develop and evaluate remedial alternatives. EPA is currently revising the draft FS, incorporating results from the final EPA-approved baseline risk assessments. The residual risk assessment approach described here is intended to support these revisions. As discussed in *Risk Assessment Guidance for Superfund* (EPA 1991a) and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988), evaluating long-term risks associated with a potential remedy involves potential residual risk and an alternative's ability to provide protection over time.

EPA has identified eight Remedial Action Objectives (RAOs) and associated PRGs for the revised FS—four for human health and four for ecological receptors. The risk-based PRGs that EPA has proposed for each RAO are based on the baseline risk assessments and on specific risk scenarios used to characterize risk. EPA developed these risk scenarios and directed the LWG to use them in the final baseline risk assessments. Consistent with CERCLA guidance (EPA 1991a) and previous agreements with EPA for this Site, to the extent practicable, evaluation of remedial alternatives should be consistent with spatial scales, spatial extents, and other aspects of the risk calculations and with results in the baseline risk assessments. Furthermore, EPA guidance states that site-specific information from the baseline risk assessment should be used in developing remedial goals and that "the final acceptable exposure levels should be determined on the basis of the results of the baseline risk assessment and the evaluation of the expected exposures and associated risks for each alternative" (EPA 1991a).

Residual risk assessment involves estimating contaminant concentrations that a remedy is expected to achieve in a given medium at various post-remediation time points and then calculating the risk associated with those estimated concentrations. The residual risk assessment for the Site will focus on those contaminants of concern (COCs) for which Remedial Action Levels (RALs) have been identified. In the revised FS technical discussions, both EPA and the LWG have generally agreed that the RAL COCs provide an appropriate bounding of both baseline risks and potential future residual risks for all COCs, for alternative development and evaluation purposes. Consequently, the LWG proposes to focus the residual risk assessments on the RAL COCs. Although the LWG does not recommend evaluating remedial alternatives for additional COCs, the residual risk assessment will consider additional COCs that EPA might decide to include in the revised FS alternatives evaluations.

A summary of the overall approach is provided in the following subsection. Following that, the methods are discussed in greater detail.

1.1 Summary of Approach

EPA (1991b) indicates that "the discussion of long-term effectiveness and permanence should include, where appropriate, an assessment of the residual risk from untreated residual waste remaining at the site." The residual risk assessment will focus on exposure pathways and scenarios that the BHHRA and BERA indicate may have unacceptable risks. Two methods are proposed to complete the evaluation of residual risks for different remedial options: one method based on forward risk calculations and another based on a comparison to PRGs. Both methods will provide information that can be used in combination to support the evaluation of remedial alternatives. Common to both methods is the use of the QEAFATE model projections to provide estimates of future sediment and surface water concentrations of RAL contaminants for each remedial alternative considered in the revised FS.

For the first method, the QEAFATE model sediment and surface water projections will be input directly in BERA and BHHRA risk equations for each scenario and pathway, to calculate residual risks. Where BERA and BHHRA risk equations require input of organism tissue contaminant concentrations, the food web model (FWM; also known as the bioaccumulation model) will be coupled with the QEAFATE model to estimate tissue concentrations for each

alternative and time point assessed. This method provides a more direct assessment for the same scenarios/receptors on which the findings of unacceptable risk in the Baseline Risk Assessments were based and allows for the quantitative assessment of the residual risks associated with the remedial alternatives for each of the scenarios/receptors.

For the second method, the QEAFATE model projections will be compared to appropriate sediment and surface water PRGs to evaluate the relative ability of each remedial alternative to achieve PRGs in these media both spatially and over time. This method provides an evaluation most applicable to the PRG comparisons that will be presented in the revised FS. This method is also most relevant to the procedures that will be used extensively in remedial design and remedial action efforts, where RALs will be applied in integrated remedial designs, and PRGs will be used to estimate and assess the performance of those designs.

One additional RAL is associated with ecological benthic risk and the use of the Comprehensive Benthic Risk Approach (CBRA). Because CBRA is based on multiple lines of evidence (e.g., bioassays and benthic toxicity models), it cannot accurately project future benthic risks. However, EPA has indicated that every revised FS alternative will actively remediate the entire extent of all CBRA areas. Therefore, it is reasonable to assume that COC exposure pathways for benthic organisms in the CBRA areas will be removed and residual risks to the benthic community for each alternative will be reduced to acceptable levels through active remediation. Nonetheless, the residual risk assessment will calculate the benthic toxicity metrics used in the CBRA, as presented in Section 2.2.

2 RESIDUAL RISK ASSESSMENT METHODS

Residual risk estimates help evaluate the relative performance of remedial alternatives against the following two FS criteria:

1. The "Overall Protectiveness of Human Health and the Environment" criterion addresses the overall ability of an alternative to eliminate, reduce, or control potential exposures to hazardous substances in both the short and long term. It also evaluates whether an alternative provides adequate overall protection to human health and the environment.
2. The "Long-term Effectiveness and Permanence" criterion evaluates the magnitude of residual risk remaining after implementation and the adequacy and reliability of control measures (e.g., containment systems and institutional controls).

The residual risk assessment will evaluate those RAL contaminants that pose significant potentially unacceptable risks for applicable human health scenarios and ecological receptors in the BHHRA and BERA.

2.1 Projection of Future Concentrations

The first step in the residual risk assessment is to make estimates or projections of future concentrations in each media (water, sediment, and tissue) for each proposed alternative. The QEAFATE model is the best tool available for the projection of future sediment and surface water concentrations within the Site for residual risk assessment purposes. Tissue concentrations can be

modeled from the projected sediment and surface water concentrations using the existing FWM. A QEAFATE model has been developed for each of the RAL contaminants, except for dioxin/furans.

QEAFATE Modeling Sediment and Surface Water Projections

The primary tools used to evaluate long-term effectiveness in the draft FS and available for the residual risk assessment are various projections output from the QEAFATE model. These include the following:

- Long-term (up to 45 years) sediment concentrations
- Long-term (up to 45 years) surface water concentrations

These model projections can be examined and summarized at any spatial scale and time scale of interest down to one model cell and one model time step, respectively. Of the RAL contaminants, existing calibrated QEAFATE models are available for total polychlorinated biphenyls (PCBs), total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), and benzo(a)pyrene (BaP) equivalent (BaPEq). Total PCBs are projected by summing model runs for five PCB homolog groups. Total DDx is projected by summing model runs for 4,4′-DDT; 4,4′-DDE; and 4,4′-DDD, and BaPEq is modeled based on BaP. It should be noted that these are approximations for total DDx and BaPEq. The utility of these approximations was assessed in draft FS uncertainty analyses, and it was found they were reasonable estimates for modeling the RAL contaminants that were well within other projection and measurement uncertainties involved in alternative development and evaluation.

The QEAFATE model includes short-term construction and long-term post-construction phases; therefore, the model integrates over time the different construction durations, associated short-term construction impacts, and long-term post-construction recovery for each remedial alternative. The construction durations vary considerably among the draft FS alternatives (i.e., 2 to 28 years) and are expected to span a similar time range for the revised FS. The residual risk assessment will evaluate QEAFATE model outputs at one to two time points within and/or right after the construction phases for the remedial alternatives (e.g., 5 and 10 years) and one long-term time point (e.g., 45 years). This will allow for a consistent comparison of both short- and long-term residual risk magnitude and risk reduction across all alternatives. Surface water ecological PRGs are primarily based on continuous chronic concentrations (CCCs). In Oregon, CCCs are applied as 4-day averages that should not be exceeded more than once every 3 years. Surface water projection time points for ecological PRG comparison will involve the calculation of rolling 4-day averages around each time point.

Dioxin/furans were not modeled using QEAFATE and are only proposed to be used in the forward risk calculation method in this residual risk assessment. For dioxins/furans, time-zero sediment surface-area weighted average concentrations (SWACs) over appropriate spatial scales consistent with risk assessment exposure assumptions will be used in forward risk calculations for both the BERA and BHHRA residual risk assessments. EPA has been developing methods to approximate time-zero SWACs for the revised FS that should also suit this purpose. However, this method for dioxin/furans does not provide a long-term estimate of alternative effectiveness or short-term estimates of the construction-related impacts.

The evaluation of PCBs, DDx, and BaPEq by the PRG comparison method and the evaluation of PCBs, DDx, BaPEq, and dioxins/furans by the forward risk calculation method will provide a thorough residual risk assessment for each remedial alternative.

Tissue Projections

Estimated tissue concentrations associated with the projected sediment and surface water concentrations for each alternative are needed for some of the forward risk calculation methods. The existing FWM will be used to estimate the future tissue concentrations of PCBs and DDx based on the sediment and surface water concentrations projected by the QEAFATE model. Existing biota-sediment accumulation regressions (BSARs) will be used to estimate BaPEq concentrations in shellfish tissue. Because no statistical relationship exists between vertebrate fish tissue and sediment concentrations, BaPEq concentrations will not be estimated for fish tissue. The FWM and BSARs will be used to estimate tissue concentrations consistent with the exposure assumptions and exposure point concentrations (EPCs) used in the BHHRA and BERA (LWG 2013a, 2013b).

2.2 Forward Risk Calculations

Forward risk calculation will replicate procedures used in the EPA-approved BHHRA and BERA, differing in that residual risk estimates for FS remedial action alternatives will be generated, rather than based on baseline risk estimates. Background risks will be estimated from projections of long-term steady state sediment COC concentrations, post-remediation. Background risks refer to risks posed by sediment and water concentrations approximately equivalent to the long term concentrations achievable at the Site. Calculations will be conducted for the receptors and exposure pathways covered by the FS RAOs and RAL contaminants. Effect thresholds (e.g., cancer slope factors and toxicity reference values [TRVs]) and exposure scenarios (e.g., fish consumption rates and spatial scales) will be the same as those used in the baseline risk assessments. The only differences between the baseline risk assessments and the residual risk assessment are as follows:

1. EPCs used in the residual risk assessment will be model-projected values of future EPCs for specific remedial action alternatives and long-term steady state concentrations, rather than empirically estimated values.
2. The residual risk assessment will allow for comparing relative residual risks for different potential future conditions (i.e., after implementing different remedial action alternatives).
3. The residual risk assessment will focus on RAL contaminants, exposure pathways, and receptors that are important for evaluating FS alternatives.
4. Residual risk assessment results will be presented concisely, referencing back to the baseline risk assessments for specific details about methods.

For each scenario/receptor, model projections at three time points will be compared in areas where risks were found to be unacceptable in the baseline risk assessments, for each evaluated remedial action alternative and long-term steady state concentrations. Spatial scales for scenarios/receptors will also be consistent with those in the baseline risk assessments.

The magnitude and extent to which the residual risks for remedial alternatives exceed the acceptable risk thresholds used in the baseline risk assessments will be presented quantitatively, compared across remedial alternatives and discussed for each time point.

Ecological Risk

Residual risks for ecological receptors will be estimated for the exposure scenarios and RAL contaminants associated with potentially unacceptable risks in the BERA. Residual risk Hazard Quotients (HQs) for fish will be calculated by comparing average residual whole-body fish tissue COC concentrations by receptor-specific exposure area to the tissue TRVs used in the BERA. Tissue concentrations will be estimated using the combination of projected sediment concentrations from the QEAFATE model and estimated tissue concentrations from the FWM. Potentially unacceptable residual risks will be identified for those COCs with HQs greater than or equal to 1.0. Magnitude and spatial distribution of HQs greater than or equal to 1.0; uncertainties about exposures, effects, and risk; and comparisons to background concentrations will be presented and discussed. This methodology is equivalent to the methodology that was used in the BERA (LWG 2013b, Section 7).

Residual risk HQs for wildlife will be calculated by comparing model-projected average residual prey tissue COC concentrations to the dietary-dose TRVs used in the BERA. Prey tissue concentrations will be estimated using the coupled QEAFATE model and FWM. HQs will be calculated over the same relevant exposure areas as in the BERA and will account for the ingestion of multiple prey species using the same assumptions as in the BERA. Just as in the BERA, residual risk HQs for wildlife will be further evaluated in light of the magnitude, spatial distribution, and frequency of HQs and the underlying uncertainties of exposure and effects data. This methodology is equivalent to that used in the BERA (LWG 2013b, Section 8).

As described in Section 1, because EPA has indicated that every revised FS alternative will actively remediate the entire extent of all CBRA areas, it is reasonable to assume that the COC exposure pathways for benthic organisms in the CBRA areas will be removed and residual risks to the benthic community for each alternative will be reduced to acceptable levels through active remediation. This approach does not account for the potential for long-term recontamination of actively remediated areas, even though draft FS model projections show that remediated areas will generally attain long-term equilibrium concentrations that are comparable to background conditions, which represent the lowest achievable risk levels for the remediation. This is also consistent with the FS assumption that upland sources will be adequately controlled prior to sediment remediation. Nonetheless, the residual risk assessment will calculate the benthic toxicity metrics used in the CBRA and compare to the agreed thresholds:

- Logistic regression model level 3 $P_{max} \leq 0.59$
- Floating percentile model level 3 mean quotient (MQ) ≤ 0.7
- Generic Probable Effect Concentration MQ ≤ 0.7

Transition zone water exposures are incorporated into the baseline risk CBRA as one line of evidence and, therefore, are addressed by this CBRA approach.

Human Health Risk

Residual risks for human health will be estimated for the exposure scenarios and RAL contaminants associated with potentially unacceptable risks in the BHHRA. The projected future EPCs for the remedial alternatives and long-term steady state concentrations will be estimated. For exposure scenarios associated with direct contact with sediment or surface water, EPCs will be estimated using the QEAFATE model for the same exposure areas evaluated in the BHHRA. For the fish and shellfish consumption scenarios, tissue concentrations will be estimated from the sediment and surface water concentrations projected by the QEAFATE model using the FWM or BSAR. Fish tissue EPCs will be estimated for a multi-species, fillet diet on a site-wide basis and for a smallmouth bass, fillet diet on a river-mile basis. Clam tissue EPCs will be estimated on a river-mile basis for each side of the river. EPCs will be estimated for each of the alternatives at the time points discussed in Section 2.1.

Cancer risks, noncancer hazards, and hazards associated with infant consumption of human milk will be calculated using the estimated sediment, surface water, and tissue EPCs and the same assumptions and risk equations as in the BHHRA. The calculated cancer risks will be compared with EPA's target range of 1×10^{-6} to 1×10^{-4}. Noncancer hazards and hazards associated with infant consumption of human milk will be compared with a target hazard index of 1.

For fish consumption, if estimated residual risks exceed target risk levels, the number of meals per month that could be consumed without exceeding target risk levels will be calculated based on the estimated tissue EPCs. This information will illustrate the level of fish consumption within target risk levels that the remedial alternatives will be able to achieve and is not restricted to the specific fish consumption scenarios evaluated in the BHHRA. A number of meals per month will be calculated for target cancer risks, target noncancer hazards, and for protection of infant consumption of human milk.

2.3 Comparison to Preliminary Remediation Goals

For the FS, attainment of RAOs by remedial alternatives is evaluated through comparison of expected future media contaminant concentrations for each alternative to numeric values such as sediment PRGs for RAL contaminants. For the residual risk assessment, multiples above the PRGs for RAL contaminants will be compared to QEAFATE model-projected concentrations in surface sediment and surface water for each alternative at various time points post-remediation. Each risk-based PRG represents attainment of "acceptable" risk levels, as described in the RAO. Risk-based PRGs are numeric expressions of the RAOs that are expected to meet acceptable risk levels targeted under the RAOs. PRGs are developed for those scenarios, receptors, COCs, and pathways representing potentially unacceptable risk at the Site where a numeric goal can be calculated. Alternatively, where unacceptable risks exist, some PRGs are based on applicable or relevant and appropriate requirements (ARARs) or background values.

The baseline risk assessments used site-specific exposure spatial scales for each human health scenario or ecological receptor. Use of the PRGs, including for residual risk assessments, should be as consistent as possible with those risk assessment exposure spatial scales to accurately assess alternative performance relative to the RAOs and to achieve a risk-based sediment cleanup as called for in the *National Oil and Hazardous Substances Pollution Contingency Plan*

(EPA 1990) and *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005). Consistent with the principles identified in the LWG's June 19, 2014 letter to EPA (LWG 2014, Attachment 1), the COCs and PRGs selected for evaluation in this residual risk assessment will be based on the application of the following principles:

- COCs should only be designated for contaminant exposure scenario pairs (ecological or human health) for which the EPA-approved baseline risk assessments identified potentially unacceptable risk from in-river media (e.g., not for potential upland sources). PRGs should be established for these COCs consistent with risk assessment methods and only where sufficient technically valid information exists to do so.
- Because RAOs "should reflect objectives that are achievable from the site cleanup" (EPA 2005), the FS should focus on those COCs and PRGs that are technically practicable to achieve and for which acceptable risk levels can be reached through the remedial action alternatives being evaluated in the FS.
- COCs and PRGs should not be established if reasonably conservative risk management principles indicate that a contaminant is not significantly contributing to risk and that evaluation of remedial alternatives with respect to a PRG for a particular COC/exposure pathway pairing is not necessary in order to select a protective remedy.

Consistent with the second principle above, the human health PRG evaluation will focus on RAL contaminants and corresponding PRGs that are technically practicable to achieve. Some human health-based PRGs identified by EPA are well below upstream background or Site equilibrium[1] estimates and are not achievable. In such cases, PRGs based on an appropriate estimate of background levels will be used to evaluate residual risk and risk reduction. For ecological risks, RAL contaminants defined in Table 11-5 of the BERA as "primary contaminants of ecological significance" (LWG 2013b, Section 3.4.2) for each receptor will be considered in the PRG comparisons. Consistent with the third principle above, PRGs for these RAL contaminant scenario/receptor pairs will be further filtered based on conservative risk management decisions regarding whether or not the contaminant is significantly contributing to risk for the scenario/receptor in question.

For PRGs based on background values, where the application of the PRG cannot be directly linked to a particular risk assessment exposure scale, the spatial scale most relevant to the background estimate should be used. In general, a site-wide spatial scale is most appropriate for almost any background-based PRG because background values are generated using either data from the entire spatial extent of the background area or data from depositing materials that apply to the entire Site (i.e., equilibrium estimates).

The risk assessments only found unacceptable risks for some RAL contaminant receptor/scenario pairs in certain portions of the Site. For example, BaPEq concentrations pose potentially unacceptable risks in sediment for some BHHRA scenarios/receptors in the lower half of the

[1] The use of equilibrium values to estimate background is discussed further in the LWG's June 19, 2014 letter to EPA (LWG 2014). From this point forward, use of the term "background" includes the concepts of both upstream bedded sediment statistics as well as within Site equilibrium estimates.

Site, but not in the upper half of the Site. Therefore, it is not necessary or appropriate for PRGs to be applied in alternative evaluations, including residual risk assessments, in areas where acceptable risk levels have already been achieved. Similarly, risk assessments were conducted on surface sediments where exposures to people and receptors can occur. Consequently, PRGs should not be applied in alternatives evaluations or residual risk assessments in post-remediation subsurface sediments, unless a reasonable potential exists for those subsurface sediments to become exposed over time through human or natural processes (e.g., maintenance dredging and erosional events). In most cases, remedial alternatives are designed to minimize exposure of subsurface contaminants (e.g., capping with appropriate armor layers); therefore, subsurface contaminants do not need to be compared to PRGs or included in residual risk assessments.

In many cases, EPA has proposed single PRGs for each COC and each RAO that are intended to address a range of human health scenarios and ecological receptors for that RAO. For example, for RAO 1, regarding human health sediment direct contact, EPA proposes one PRG for each COC for beach sediment and one PRG for each COC for in-water sediment. However, the BHHRA evaluates several beach scenarios and several in-water sediment scenarios, each of which has a specific PRG for each COC (where calculable), as described in Appendix Da of the draft FS (LWG 2012). For the residual risk assessment, the LWG proposes that the specific PRG for each RAL contaminant relevant to each scenario/receptor (where calculable) would be used consistent with the final baseline risk assessments. In addition, the LWG currently disagrees with EPA on the calculation methods for some PRGs, as described in the LWG's June 19, 2014 letter to EPA (LWG 2014). Therefore, calculation methods for each specific PRG and COC under each scenario/receptor will need to be determined at a later date, consistent with all PRG calculation methods and eventual EPA directives on PRGs.

For each scenario/receptor, model projections at three time points will be compared in areas where risks were found to be unacceptable in the baseline risk assessments. Spatial scales for scenarios/receptors will also be consistent with those in the baseline risk assessments. The resulting comparison will be presented as follows:

- Residual Concentrations Compared to PRGs—Residual concentrations will be compared to PRGs for each relevant scenario. The comparison will be expressed as a ratio of the projected residual concentration to the PRG at three time points.
- Magnitude of Risk—The degree to which the alternative exceeds the acceptable risk level represented by the PRG will be presented quantitatively and discussed for each time point. For example, if Alternative B exceeds a PRG in relevant portions of the Site by 20 times and Alternative D exceeds that same PRG in the same portions of the Site by 2 times, the residual risks for Alternative B are an order of magnitude higher than Alternative D for that portion of the Site for that scenario.
- Risk Reduction—The amount of risk reduction achieved by each alternative will be presented by comparing the magnitude of the PRG exceedance to the baseline condition PRG exceedance. For example, if under the baseline condition the PRG is exceeded by 10 times, Alternative B exceeds the PRG by 4 times, and Alternative D exceeds the PRG by 2 times, then Alternative B achieves a 60% risk reduction and Alternative D achieves an 80% reduction from baseline conditions.

The residual risk evaluation process is appropriate for ecological risk-based PRGs and human health risk-based PRGs for carcinogenic RAL contaminants. However, for human health PRGs based on noncarcinogenic endpoints or developed for the breastfeeding infant exposure pathway, the unacceptable risks associated with the PRGs are not necessarily linear. This is also true for human health PRGs based on ARARs or background values for which the PRGs are not based on a specific acceptable risk level. For these PRGs, the residual risk PRG comparisons will be presented based only on the remedial alternatives' ability to achieve the PRGs and the relative magnitude of each alternative to achieve the PRG in a similar manner, as in the above three bullets.

Finally, for human health, groundwater (RAO 4) will not be included in the residual risk assessment evaluation because groundwater was not evaluated in the BHHRA, no potential unacceptable risks were found for shoreline seeps in the BHHRA, and direct groundwater remediation is not evaluated in the FS.

3 NEXT STEPS AND SCHEDULE

It is anticipated that the residual risk assessment will commence once final COCs, PRGs, and comprehensive remedial alternatives are identified for the revised FS. EPA's proposed alternatives can then be compared to the draft FS alternatives and associated QEAFATE model projections to determine whether existing model projections can be used for the residual risk assessment or additional model runs are required.

Given that all issues in Section 4 of the revised FS are scheduled to be resolved by November 2014, the proposed schedule for the residual risk assessment is to initiate the assessment in the fourth quarter of 2014 and complete it in the first quarter of 2015.

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